

RESEARCH STUDY INTO THE BARRIERS TO THE MAINSTREAM ADOPTION OF BIM

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ABSTRACT

The field of modeling & simulation has revolutionized the way of achieving the accuracy, solving problems in various engineering & non engineering spheres, as it helps us to obtain the information how something will behave without testing it in real life. Modeling & Simulation has already helped to reduce costs, increase the quality of product/outcomes in various fields and the construction industry is no exception to it. This paper discusses about digital modeling of buildings, their advantages and problems in their implementation and suggesting possible remedies

KEYWORDS: BIM, Interoperability, Transactional Business Adoption, 4Dmodelling, 5D Modeling, ND Modeling

INTRODUCTION

Building information modeling more precisely named as BIM in its simplest terms is a powerful tool in architecture engineering and construction (AEC) industry by which a digital model of a building is created, which enables anyone to understand every aspect of the building much before its real existence. BIM brings together all of the information about every component of a building, in one place. It makes it possible for anyone to access that information for any purpose, e.g. to integrate different aspects of the design more effectively. In this way, the risk of mistakes or discrepancies is reduced, and abortive costs minimized.

BIM data can be used to illustrate the entire building life-cycle, from cradle to cradle, from inception and design to demolition and materials reuse. Spaces, systems, products and sequences can be shown in relative scale to each other and, in turn, relative to the entire project. And by signaling conflict detection BIM prevents errors creeping in at the various stages of development/construction

HISTORY OF BUILDING MODELING /DRAWING

Until mid 19th century engineers used simple tools (pen, paper and ruler) to create building drawings. However with the advancement in mathematics, building materials and radical evolution of computer science in 21st century the process of building modeling and consequently building design changed rapidly & a total paradigm shift towards computer modeling happened with the invention of computers. [1-2]

Initial 2d Cad Method

2D CAD was a new tool adopted by AEC industry for building drawing. At the beginning the technology of CAD was not as popular as in modern times however with the popularization of personal computers the renowned software company AUTODESK developed AUTOCAD. Suddenly all the architects in the world started to learn & use this software to draw and model their projects

Current Design Methods

2D CAD developed into 3D modeling. This innovation changed the process of building design and the relationship between structural engineer and architectural designer. It did not only change the way building designs are visualized but also signaled a paradigm shift in design thinking from pure visualization to simulation

Building Information Modelling

Beyond 3D modeling, BIM is emerging as a new powerful technology. Firstly it has all the advantages of 3D CAD, which is merely a collection of points, lines, 2d shapes, & 3d volumes. However in BIM concept such geometric entities can also have symbolic or abstract meaning as well as qualitative or quantitative data. BIM has innumerable advantage over cad drawing, some of which have been briefly explained below

Bim Vs Autocad (Advantages of Bim)

Buildings have become increasingly complex. They are one a kind of products requiring multidisciplinary design and fabrication skills. Design and co ordination with 2D CAD system is error prone, labour intensive and relies on long cycletimes. BIM addresses these problems in that it allows for the virtual construction for the components and coordination among all the business system prior to producing each piece. Unlike cad which primarily automates aspects of traditional drawing production, BIM is a paradigm change. BIM redistributes the distribution of effort, placing more emphasis on conceptual design. BIM is relatively a fair new concept and it will take time to realize its full advantages. some identified advantages of bim are as

Early Modification

One of the biggest advantages with BIM is the ability to make changes easily, even late in the project. This means late changes to a design may be done with much less effort than previously and that more options can be explored during the early design process. In short the design issues can be addressed and modified earlier as a result of modified visualization saving time & reducing cost

Construction Planning

Bim models allow for improved construction and increased co ordination of construction documents. In the bim process all of the information comes from one file so it is up to date and well co ordinate. Co ordination means that when you change suppose a door at one place, the door will be updated in every other place. In contrast when using a traditional CAD, THE person drawing must remember every place where the door occurs and go back into each drawing file and manually change each door in view

Document Extraction

BIM has the technology to produce several user friendly documents needed during the course of a project. A design project can contain over thousands document pages. However with BIM you have a model from which any of these documents can be produced. This feature eliminates field or shop drawings by having all parties work within the shared model. Two & three dimensional pdf files can also be generated to give the owners and employees enhanced visualizations of the design process

Data Extraction for Analysis

Bim provides specialized analysis tools to extract data from the design process and perform valuable analysis. The different professions in construction such as architects, engineers etc use this capability for different tasks. Any category of data needed can be obtained from the work done in BIM process

Material Takeoffs

BIM allows us to request certain information from the database in order to have an idea of the quantities of certain type of materials used for the design such information can include “how many cubic meters of concrete may be used for foundations? Or “how many square meters of a particular type of timber are required?”

Accuracy

Unlike 3Dcad models where accuracy is not of prime importance because of models’ main function of enabling visual communication, the BIM model has to be accurate as every architectural and engineering representation has to fit within an integrated data environment. As a result there are high accuracy levels in BIM representations

Controlled whole life Costs & Environment Data

BIM model can also be used to understand and predict the environmental performance of a building and its life cycle costs during the management period of the facility

Problem Identification

BIM models help identifying problem areas within the design which would not have been easy to identify with 2D/3D cad

Interoperability

adopting the bim technique will also enable interoperability among the industry professionals as the industry foundation classes (IFC) creates the desired platform for facility managers to share digital data sets (Gillard et al. 2008). The importance of BIM tool with its interoperable platform is reflected in national institute of standards & technology’s study (NSIT 2004), which estimated that the cost of inadequate interoperability to the US capital facilities industry was approximately 15.8 us dollars in 2004

There are several other features BIM can offer. For example, 4D technologies, which utilize space and time, can be used for scheduling, sequencing and cost analysis. With 4D, one can digitally watch the project being built along a very closely estimated timeline, which gives an approximation of the time, money and other details needed for the entire project. The model is created and modified before construction, making it easier to visualize the building process and make any needed modifications, which will prevent the majority of the conflicts that normally take place throughout the project. Adding a cost component to 4D modeling creates a 5th dimension, making a 5D model. Such 5D engineered models allow stakeholders to evaluate cost & model cash flows for each phase of construction thus a 5D model looks just like a 3D model, but it includes component pricing and budgeting reports for the job. Thus BIM can be 3D, 4D (3D integrated with time), 5d (4D integrated with cost) right up to ND (a term that covers any other information). As a receptacle of project information BIM has massive versatility & potential

Utilizing BIM technology has major advantages for construction that save time and money. An accurate building

model benefits all members of project team. It allows for a smoother and better planned construction process that saves time and money and reduces time & money and reduces the potential for errors. In order to practically compare the difference between the traditional cad documents & BIM leicht & lessner used these two different methods to create the same project named Dickson school of law building in Penn state university in the USA. It is easier to analyze the benefits using BIM [3]

BARRIERS TO THE MAINSTREAM ADOPTION OF BIM AND POSSIBLE REMEDIAL SUGGESTIONS

Since BIM is an emerging technology, it is going to have several risks and liabilities that go along with it. Obviously, one of the biggest risks a firm takes with BIM is errors in accuracy. Since the model is the core of the project, just one error in precision can be very costly. With today's project method, there are several different sets of plans that can be used to check one another and prevent such mistakes. With BIM, the plans are generated from the model, so they all reflect the same data, making it harder to catch small miscalculations that can lead to bigger problems.

Another setback that can arise is the price tag. BIM technologies, such as training, software costs and required hardware upgrades, are costly and it takes a lot of time to implement them into an existing process. Adequate training is needed in different areas, and levels of expertise can vary. The problem here is that because such a large amount of data is exchanged among team members, there is the risk that any weak link in the group could endanger the entire project. Also, staff buy-in is crucial to the success of BIM. There are general concerns that senior level management may not embrace BIM. Being higher in administration, they may not feel comfortable validating the costs and efforts associated with implementing BIM. Since they have been part of the organization for so long, they may be used to the current process, resulting in a hesitation to change the way they run their business. Another drawback lies in the ownership determination of BIM data between the client and the design provider. Since client is paying for it therefore he may feel entitled for its ownership however if the designer has provided some proprietary information necessary for the project, that needs to be protected causing a clash between the two parties

Even though BIM has revolutionized the entire process of building right from planning to its execution & demolition yet there are some drawbacks that prevent its mainstream adoption. The following is an enumeration of the barriers of the mainstream adoption of BIM along with some suggested remedies

The Evolution of the Transactional Business Process: A constantly developing transactional business process only gets rid of many potential conflicts without tackling any primary lack of preliminary process incorporation [4]

The Computability of Digital Project Data: Designers still have to do many calculations by hand because a majority of word processing requests does not carry out computations inside tables [4]. A remedial solution for this barrier is employing computer applications that emulate a drafting protocol that enhances performance for designers and engineers.

Significant Information Interoperability Making the resultant information available to all pertinent individuals and groups of individuals in the building procedure is an obstacle when adopting BIM [4]

A remedial solution for this barrier is an established need and stipulated transnational issue that simple information transmission tools such as gbXML could detect.

The most important barrier to the mainstream adoption of BIM is the evolution of the transactional business process. This barrier is important because the lack of the integral incorporation of design information in a model-oriented design-to-build procedure will cause the procedures themselves to fail to mature appropriately. This failure may be evident in the backup tools and their information too [5]. This barrier needs to be resolved because the discrete parameters of duty become obscure when more information relationships are set up. As a result, there develops a need to design new methods for distributing risk¹.

The first users of BIM proposed possible remedial solutions to a number of queries about the fair assigning of risks and the tracing of design decisions to their exact creators. First, mainstream adopters of BIM can set up model-oriented tasks often because they are very cooperative projects. The design group of such a project agrees to incorporate data entirely from all fonts in the course of the design process. This agreement includes the originator who is often at the managerial level of the project from its beginning. This solution naturally defines risk as an element distributed across the whole design group [6] For example, AIA Group Limited sought to come up with such definitions to integrate an approach with this solution. The company wound up having properly defined workflows and information interactions.

Another remedial solution is adding the proprietor to the project's design group who will utilize the model as a design management instrument [7]. However, this solution is bound to make designers charge more money for BIM-centered approaches and appropriate risk allocation in their agreements. This increase in fees is the result of the clarity of increase in the value of such owner-included strategies in design groups through design that is more organized and projects built on strict timetables and tight budgets. For example, when an electrical engineer draws up a backup lighting structure, he or she has to be aware of the color or kind of the floor sets inside the room irrespective of their cost

CONCLUSIONS

Building information modeling is emerging as an innovative way to virtually design and manage projects and has unprecedented advantage over other similar technologies. yet the drawbacks like accuracy, copyright problems, huge computability, high costs, interoperability, business transaction process etc are pre empting its mainstream adoption & usage. Unfortunately the AEC industry is not glad to invest in BIM because of the lack in case study evidence of the financial benefit (return of investment) of BIM.If these drawbacks are judiciously taken care of then the real potential of BIM can be unveiled. It will be easier to operate & manage a project and we will be able to adapt this rapidly changing building environment. As the use of BIM accelerates, collaboration within project teams should increase, which will lead to improved profitability, reduced costs, better time management, and improved customer–client relationships. As a number of researchers, practitioners, software vendors, and professional organizations are working hard to resolve these challenges, it is expected that the use of BIM will continue to increase in the AEC industry.

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